

**SUMMARY OF 2000 MASSACHUSETTS
PIPING PLOVER CENSUS DATA**

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ABSTRACT

This report presents the results of Piping Plover (*Charadrius melodus*) management and monitoring efforts conducted by cooperators throughout Massachusetts in 2000. Observers reported plovers nesting at 102 sites; 38 additional sites were monitored but no breeding pairs were detected. The Index Count (conducted during a standardized nine-day period) was 484 pairs (a 2.8% decrease from 1999), and the Adjusted Total Count (estimated total number of pairs that nested during the entire season) was 496 pairs. Overall, 44% of nests hatched ≥ 1 egg, 41% of eggs hatched, and 47% of chicks fledged. Overall productivity for 487 of 496 pairs (98%) was 1.08 chicks fledged per pair, the lowest since 1987. The most common cause of nest loss was flooding, followed by abandonment and predation. Harassment by predators and severe inclement weather were the primary suspected causes of nest abandonment. Exclosed nests were abandoned more frequently than were unexclosed nests (19% vs. 8.5%); however, nest success was higher for exclosed nests than for unexclosed nests (67% vs. 38%). The most frequently identified nest predators were crows, followed by skunks. Storms resulted in the loss of 178 nests to flooding and were implicated in the disappearances of approximately 100 chicks. Observers reported an unusually high number of instances (thirteen) of renesting by plover pairs that lost chicks. Eleven adult plovers were found dead during the season.

INTRODUCTION

The Piping Plover (*Charadrius melodus*) is a small, sand-colored shorebird native to North America. Three breeding populations (Atlantic Coast, Great Lakes, and Northern Plains) are recognized (Haig 1992). In Massachusetts, Piping Plovers arrive from mid-March through May to nest on sandy coastal beaches and dunes. Generally, nests are located on sandy or gravelly substrate in sparsely vegetated areas, and are frequently associated with nests of the Least Tern (*Sterna antillarum*), with which the Piping Plover shares similar nesting habitat requirements (Blodget and Melvin 1996).

The Atlantic Coast population of the Piping Plover has been federally listed as "Threatened" since 1986. It is also listed as "Threatened" pursuant to Massachusetts' Endangered Species Act. Currently, major threats to the Piping Plover are mammalian and avian predation, habitat degradation, and disturbance and direct mortality of eggs and chicks caused by beach-users and off-road vehicles (Hecht et al. 1996).

Massachusetts plays a pivotal role in the recovery of this species. Following federal listing of the Piping Plover, the Division of Fisheries and Wildlife began to work towards population recovery by intensively managing and monitoring plovers at all nesting sites. Specific recovery goals for New England include increasing the population to 625 breeding pairs and achieving five-year average productivity of 1.5 chicks per pair (Hecht et al. 1996). As a result of intensive management and abundant, high-quality habitat, Massachusetts' Piping Plover population has grown from 127 pairs in 1987 to about 500 pairs presently, and the state harbors 80% of approximately 625 pairs breeding in New England and 36% of the entire Atlantic Coast

population that breeds from Newfoundland to North Carolina (Melvin and Mostello 2000, USFWS 2000). Productivity remains highly variable among years.

In this report, we detail the results of the 2000 season of Piping Plover monitoring and management by an extensive network of cooperators throughout Massachusetts. Specifically, we report on abundance, distribution, breeding performance, and causes of nest loss and chick and adult mortality.

METHODS

Monitoring and management of Piping Plovers and other coastal waterbirds in Massachusetts is carried out by a coast-wide group of cooperators composed of full-time and seasonal biologists, beach managers, researchers, and volunteers. The data summarized in this report were contributed by over 70 individuals. Cooperators monitored 140 sites in Massachusetts in 2000 for the presence of breeding Piping Plovers. We define breeding pairs as pairs observed with either a nest or unfledged chicks or that exhibit site tenacity and evidence of pair bonding and territoriality for at least two weeks.

Abundance

Beginning with this report for the 2000 breeding season, we are reporting three different measures of abundance for Piping Plovers in Massachusetts: the *Index Count*, *Unadjusted Total Count*, and *Adjusted Total Count*. The *Index Count*, as reported since 1990, is the total number of pairs tallied statewide each year during a nine-day count period in late May and early June, standardized each year for the entire Atlantic Coast. In 2000, the *Index Count* period was 27 May to 4 June. The objective of the *Index Count* is to estimate population size with a minimum of double-counting of pairs that move between or within sites, thereby providing an index to population trends that is likely more precise than counts based on observations made over longer periods of the breeding season. We believe the *Index Count* minimizes double-counting because it occurs over such a short period of time. However, we also recognize that it probably consistently underestimates actual breeding population size, because it does not include pairs that leave the state before the count period, arrive after the count, or simply go undetected during the nine-day count period.

Beginning with the 2000 census, we are reporting two different "Total Counts". The *Unadjusted Total Count* is a simple tally of the total number of pairs reported for all sites by all observers over the course of the entire nesting season, with no attempt made to adjust for pairs that may have been double-counted if they nested unsuccessfully at one location and then re-nested at another. We then derived an *Adjusted Total Count* by calculating the average of the *Index Count* and the *Unadjusted Total Count*, rounded to the nearest whole number of pairs. The *Unadjusted Total Count* is simple and relatively objective to calculate, but undoubtedly overestimates the actual population by double-counting pairs that establish nesting territories at more than one location in a given year. Because birds are not color-banded, and given that nearly 500 breeding pairs are present in Massachusetts each year and up to 50% or more of nests in a given year are unsuccessful, it is impossible to accurately and objectively determine which

birds nest at multiple locations within a breeding season or simply do not arrive or begin breeding activities until June. It has become too time-consuming, subjective, and, we suspect, inaccurate to try and adjust the total count of pairs each year by not tallying late-nesting pairs (*i.e.*, pairs reported as “new” pairs that nested after the first week in June), based on the assumption that these birds were probably already counted earlier in the season. Instead, we are reporting an *Adjusted Total Count*, calculated as the mid-point between the *Index Count* and the *Unadjusted Total Count*. We suspect that the *Adjusted Total Count* is the most accurate estimate of the actual number of breeding pairs in Massachusetts, because it falls midway between the *Index Count* and *Unadjusted Total Count* which we believe underestimate and overestimate, respectively, the actual breeding population. We calculated the *Index Count*, *Unadjusted Total Count*, and *Adjusted Total Count* for the entire state, and also separately for each region within the state.

Reproductive success

The primary measure of reproductive success that we report is *productivity*, measured as number of chicks fledged per pair. The denominator of this ratio is the number of breeding pairs for which fledging data are reported; this includes not only pairs that successfully fledged chicks, but also all pairs for which it can be confidently determined that they fledged no chicks, either because they nested unsuccessfully (*i.e.*, no eggs hatched), or because none of their chicks survived to fledge. Beginning this year, we are reporting two different “Numbers of pairs with fledge data.” As for counts of breeding pairs, estimates of pairs for which fledging data are reported will be biased if any double-counting of pairs occurs. Double-counting will overestimate the number of pairs in the denominator of the productivity ratio, and thereby will underestimate actual productivity. To reduce the potential bias associated with double-counting, we multiplied the *Unadjusted number of pairs with fledge data* (a tally of the total number of pairs with fledge data reported for all sites, with no attempt made to adjust for pairs that may have been double-counted) by the ratio of the *Adjusted Total Count* to *Unadjusted Total Count* to arrive at the *Adjusted number of pairs with fledge data*. We used this method to calculate productivity for the entire state, and also separately for specific regions of the state, unless examination of the count data revealed no pairs that were likely to have been double-counted (*i.e.*, pairs that nested unsuccessfully and left a territory before or during the first week in June, or were reported as new pairs after the first week of June).

We also report the following measures of reproductive success for the entire state: *observed nest success* (percentage of nests that hatched ≥ 1 egg), *observed hatching success* (percentage of eggs that hatched), and *observed fledging success* (percentage of chicks that survived to 25 days of age or were able to fly ≥ 50 feet, whichever occurred first).

Data reporting and quality control

All data were reported by cooperators who filled out a standard Massachusetts Piping Plover Census Form for each site visited. This form requests data on number of breeding pairs (*Index Count* and *Total Count*); frequency of site visits; exclosure design and installation date; dates of nest discovery, completion, hatching, and failure; number of eggs when the nest was discovered; total numbers of eggs laid, eggs hatched, and chicks fledged; reasons for egg and

chicks loss; and general comments and management needs. Maps of sites showing the locations of all nests were also requested.

Upon receipt of forms, we contacted cooperators to obtain missing data, resolve inconsistencies (*e.g.*, pairs actually present during the *Index Count* period, timing of loss of first nest vs. appearance of “renew”) and clarify ambiguities (*e.g.*, degree of certainty about, and evidence to support, cause of nest failure or chick loss). Unsuccessful nests were then assigned to one of several categories of nest failure: predation (*e.g.*, by fox, skunk, crow, gull, other, or unknown); flooding/overwash; abandonment (*e.g.*, due to egg inviability, inclement weather, disturbance, harassment, adult disappearance/death, other, multiple causes, or unknown); unknown; or other (*e.g.*, vandalism, inviable eggs removed by monitor).

RESULTS AND DISCUSSION

Abundance

Observers reported breeding Piping Plovers at 102 sites in Massachusetts during the 2000 breeding season. An additional 38 sites were monitored one or more times during May and June, but no breeding pairs were detected (Table 1).

The 2000 Index Count was 484 pairs, the Unadjusted Total Count was 507.5 pairs, and the Adjusted Total Count was 496 pairs (Table 1). The Index Count was 98% of the Adjusted Total Count, and a 2.8% decrease from the 1999 Index Count of 498 pairs (Fig. 1). This is the first time that the number of pairs of Piping Plovers present during the Index Count has decreased in Massachusetts since comprehensive statewide surveys began in 1986 (Fig. 1). Due to the change in our calculation methods, the Adjusted Total Count is not directly comparable to Total Counts in past years, but it, too, suggests that the number of pairs has stabilized or decreased.

Three regions harbored 68% of the total pairs breeding in the state: the Lower Cape (34%), the Upper Cape (21%), and the North Shore (13%) (Fig. 2). Sites with the largest number of breeding pairs were Crane Beach in Ipswich (46 pairs), South Beach in Chatham (34), Sandy Neck in Barnstable (29), and South Monomoy Island in Chatham (29). Sixteen sites reported ≥ 10 pairs, and collectively they accounted for 57% of all pairs. At the other end of the size spectrum, 65 sites with ≤ 3 pairs collectively supported 20% of the state’s Piping Plover population.

Reproductive success

Overall observed nest success was 0.44 (331 of 759 nests hatched ≥ 1 egg). For nests protected with exclosures, nest success was 67%, as compared to only 38% for nests without exclosures (Table 2). For 732 nests for which complete data were reported, observed hatching success was 0.41 (1,079 of 2,624 eggs hatched). Sixty-two percent of eggs protected with exclosures hatched compared to only 37% of unprotected eggs (Table 3). Fledging success was 0.47 (503 of 1,079 chicks survived to fledge). These are the lowest hatching and fledging successes reported since these parameters were first calculated in 1992 (Fig. 3).

During the 2000 nesting season, overall mean productivity was 1.0⁹ chicks fledged per pair based on data from an estimated 487 of 496 pairs (98%) (Figs. 1 and 3). This is the lowest productivity recorded in Massachusetts since 1987 (the first year that such data were collected), when productivity was 1.07 chicks fledged per pair. In 2000, only two (Elizabeth Islands and Nantucket/Tuckernuck/Muskeget Islands) of the eight regions of the state averaged > 1.5 chicks per pair, and two regions (North Shore and Martha's Vineyard) averaged < 1.0 chicks per pair (Fig. 4). In 1999, five regions averaged > 1.5 chicks fledged per pair, and two regions averaged < 1.0 chicks per pair.

In 2000, the low values for hatching and fledging success, and thus, for productivity, can be attributed in large part to inclement weather, but other factors were also important. The loss of 178 nests due to storms was the greatest we have recorded since monitoring efforts began in 1986. The next most common cause of nest loss was abandonment, followed by unidentified predators and predation by crows and skunks (Table 4). Wire predator exclosures were used to protect 511 of 759 nests (67%). Nineteen percent of nests in exclosures were abandoned (97 of 511 nests) compared to only 8.5% of nests without exclosures (21 of 248 nests). Causes of nest abandonment were reported as unknown in 54 of 118 instances (46%) (Table 5). The most commonly suspected causes of nest abandonment were harassment by predators (16 nests), severe inclement weather (16 nests), and death of one of the adults (10 nests).

Causes of mortality

Chicks. As usual, few causes of chick mortality were directly observed. Storms (particularly a severe coastal storm on 6 and 7 June) and heavy rain in June and July were implicated in the disappearances of about 100 chicks, ages zero to at least eighteen days old (ages when lost were not always reported). In one case, two newly hatched chicks at Sagamore Beach were known to have been washed over in the nest. At Duxbury Beach, a ten day-old chick that kept getting separated from its parents stopped moving. It was brought to a rehabilitation center where it died that day. Inclement weather and the disappearance of one parent may have contributed to its demise. Three chicks from a one to two day-old four-chick brood at Duxbury exhibited motor coordination problems. Two were taken to a rehabilitation center and the third disappeared. The fourth disappeared after the disappearance of one of the adults. A pair of adults disappeared from Duxbury when their three chicks were six days old. The next day, one chick was found dead and another was missing. One adult returned one to two days after it had left, but the other never returned. The third chick was missing a week later. One chick at Dead Neck and one at North (Nauset) Beach, Orleans were found dead of unknown causes. At Sandy Neck, a one day-old chick was apparently run over by a plover monitor on an off-road vehicle. Following this incident, the area in which plover monitors would be allowed to use vehicles was further restricted. At Kalmus Park, Hyannis a brood of three chicks appeared weak and malnourished; one was found dead and the others disappeared when five to six days old. At Little and Lighthouse Beaches, Edgartown three chicks disappeared from an area in which Northern Harrier and crow predation on Least Tern chicks had been observed. At Edgartown Great Pond, four newly hatched chicks disappeared. Skunk tracks were abundant near the exclosure and plover broken-wing display marks were present, suggesting that the

parents attempted to distract the skunks. At Tashmoo in late May, four newly hatched chicks disappeared after a day of very high winds.

Adults. Observers reported a total of eleven adult Piping Plovers found dead in Massachusetts in 2000, the most reported since we began keeping records in the mid-1980s. At Sandy Point, a crow killed an adult by standing on the netting on top of an enclosure and grabbing the plover as it flew up inside the enclosure. The crow was later observed harrassing the four newly hatched chicks, three of which managed to fledge. At Crane Beach, one headless adult plover was found inside an enclosure; there were no tracks near the enclosure, and a "smart" crow such as the one at Sandy Point was suspected. A second adult at Crane Beach was attacked near the edge of its enclosure by an unknown predator; it made its way back into the enclosure, but its wing had been torn off. At Smith Point, an adult plover was found dead inside an enclosure; the necropsy report indicated that it had been killed by a predator (possibly one with talons), based on the presence of multiple dorsal and lateral punctures and extensive hemorrhage. An adult found dead at Eel Point may also have been a victim of a predator with talons, based on necropsy findings of multiple puncture wounds and massive hemorrhage. At South Beach, Chatham six adults were found dead. One of these, perhaps a "smart" crow victim, was found dead inside its enclosure. There were feathers and flesh stuck in the netting, and crow tracks were present all around the enclosure. The other five mortalities may have been related to a specific enclosure design in which the bottom of the exposed 2" x 4" fencing had 20-gauge wire woven through it to make 2" x 2" fencing. Blood drops found directly on the enclosure wire in two cases suggest that the birds were injured on the wire. For two other exclosed nests, clumps of feathers were found near the nests; for one of these, blood was found in the sand outside the enclosure. At another nest, an adult was found buried in the sand after a windy period. The plover monitors speculated that birds became caught on the wire and were either mortally wounded or were preyed upon. (In one case, a few skunk tracks were present around the enclosure, and in another, there were skunk tracks in the vicinity of the nest, but the nest may have been abandoned up to a week prior to discovery of the dead adult.) All exclosures were dismantled following these discoveries. At Duxbury Beach, five adults from four broods of chicks disappeared in the second half of July. Only one adult ever returned, and chicks from only one brood (that had one remaining parent) fledged.

Renesting following brood loss

In 2000, observers reported an unusually high number of instances (thirteen) of renesting by pairs that lost chicks. While renesting following egg loss is common, renesting following chick loss is atypical behavior for the Piping Plover, and usually \leq one to three instances per year are reported in Massachusetts. Suspected renesting following brood loss was reported from Ellisville Harbor, Scorton Neck, Scorton Shores, Nauset Spit, Richmond Pond, Joseph Sylvia State Beach, Squibnocket Beach, Hummock Pond, Springhill Beach (two pairs), Kalmus Park, and Sandy Neck (two pairs). Ages of the chicks when lost ranged from zero to at least eleven days old. Seven of the thirteen broods were lost during the 6-7 June coastal storm. Without banded birds, it is impossible to determine with certainty whether or not earlier and later nests were, in fact, from the same pair. It is possible that some "renests" were actually nests of new pairs that moved to the beaches; however, locations of the later nests relative to the earlier nests

suggested that the later nests were, indeed, renests by the same pairs. Additionally, the nesting chronologies did not rule out the possibility that these second nests were, indeed, renests.

ACKNOWLEDGEMENTS

We extend our sincere thanks to the many biologists, seasonal staff, beach managers, landowners, and volunteers that participated in conservation efforts on behalf of Piping Plovers and other coastal waterbirds in Massachusetts in 2000. This work was carried out by cooperators from over 30 state and federal agencies, local municipalities and county governments, private conservation groups, and universities. We especially thank all the individuals who participated in population monitoring and submitted the data that are summarized in this report.

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Table 1. Abundance, distribution, and productivity of Piping Plovers in Massachusetts, 2000.

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
NORTH SHORE					
Salisbury Beach, Salisbury	0	0	0	0	SvO
Salisbury Bch. St. Res., Salisbury	0	0	0	0	SvO
Plum Island-North End, Newburyport/Newbury	0	1	0	1	DM, LMc
Parker River NWR, Newbury/Rowley	10	11	9	11	DM, LMc
Sandy Point State Res., Ipswich	3	2	3	2	DM, LMc
Crane Beach, Ipswich	45	46 ^e	12	46	WC
Coffin's Beach, Gloucester	2 ^f	1 ^f	0	1	SH
Wingaersheek Beach, Gloucester	nd ^g	nd	nd	nd	-
Good Harbor Beach, Gloucester	0	nd	nd	nd	SH
SOUTH SHORE					
Third Cliff, Scituate	3	4	6	4	LM
Fourth Cliff, Scituate	1	1	0	1	LM, FZ
Rexhame Beach, Marshfield	1	1	2	1	LM
Duxbury Beach, Duxbury/Plymouth	9 ^h	9 ^h	7	9	LM

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledged data	Source ^d
	Index Count ^a	Total Count ^b			
Plymouth Beach, Plymouth	10	10	13	10	OM, BT
Ellisville, Plymouth ^l	3 ^l	3 ^l	4	3	MZ
Sagamore Beach, Bourne and Sandwich	5	5	4	5	MZ
Scusset Beach State Res., Sandwich	1	1	3	1	MZ
UPPER CAPE					
Mashnee Dike, Bourne	1	1	2	1	MZ
Black Beach/Sippewisset, W. Falmouth	0	0	0	0	MBa
Woodneck Beach, W. Falmouth	0	0	0	0	MBa
Washburn Island, Falmouth ^k	3	3	10	3	MC
South Cape Beach, Mashpee	4	4	2	4	MC
New Seabury, Mashpee	2	2	0	2	MC
Rock Landing/Maushop Village, Mashpee	nd	nd	nd	nd	-
Popponeset Spit, Mashpee	4	4	6	4	MC
Town Neck Beach, Sandwich	3	3	2	3	LJ, CF
Springhill Beach, Sandwich	12 ^l	12 ^l	13	12	LJ, CF
East Sandwich Beach, Sandwich	nd	nd	nd	nd	-

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Scorton (Neck) Creek, Sandwich	4 ^m	4 ^m	2	4	LJ, CF
Scorton Shores, Sandwich	2 ⁿ	2 ⁿ	2	2	LJ, CF, CN
Sandy Neck, Barnstable	29 ^o	29 ^o	28	29	HD, CN, RK
Sampson's Is.-Dead Neck, Barnstable	10	10	30	10	MR, CMc
Bone Hill Road, Barnstable ^p	0	0	0	0	MBa
Dowse's Beach, Osterville	1	1	2	1	MBa, RK, CN
Long Beach, Centerville	4	4	4	3	JI, MBa, ML, TC
Squaw Island, Hyannisport	2	2	4	2	BS
Kalmus Park Beach, Hyannis	6 ^q	6 ^q	4	6	BS
Gray's Beach, Yarmouth	2	2	nd	0	MB, JB, MS
Seagull Beach/Radio City, Yarmouth	3	4	9	4	JB, MS
Great Island, Yarmouth	6	6	4	4	JB, MS, MR
Bass River Beach, Yarmouth	nd	nd	nd	nd	-
West Dennis Beach, Dennis	2	3	7	3	AF
Chapin Beach, Dennis	1	1	0	1	AF
Mayflower Beach, Dennis	nd	nd	nd	nd	-
Howes St. Beach, Dennis	1	1	0	1	AF

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledged data	Source ^d
	Index Count ^a	Total Count ^b			
Town Landings, Dennis	nd	nd	nd	nd	-
Corporation Beach, Dennis	0	0	0	0	MBa
Sesuit Beach, Dennis	nd	nd	nd	nd	-
Quivett Neck/Coles Pond, Dennis	0	1	0	1	AF
Wings Island, Brewster	0	0	0	0	MBa
Robbins Hill Beach, Brewster	nd	nd	nd	nd	-
Town Beach, Brewster	nd	nd	nd	nd	-
Ellis Launching Beach, Brewster	nd	nd	nd	nd	-
Crosby's Landing Beach, Brewster	0	0	0	0	MBa
Paine's Creek, Brewster	nd	nd	nd	nd	-
Merkel Beach/Wychmere, Harwichport	1	1	4	1	MBa, JB
Red River Beach, Harwich	nd	nd	nd	nd	-
LOWER CAPE					
Forest Beach, Chatham	nd	nd	nd	nd	-
Cockle Cove/Ridgevale Beach, Chatham	1	1	0	1	MBa
Harding Beach, Chatham	1	2	5	2	MJ, JB, KB, JT, AT, MBa

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Harding Beach Point, Chatham	nd	nd	nd	nd	-
North Monomoy Island, Chatham	1	2	3	2	SKo, SF
South Monomoy Island, Chatham	27	29	38	28	SKe
South Beach, Chatham	32	34 ^r	10	34	MJ, HB, KM
Tern Island, Chatham	1	3	4	3	MJ, HB, KM
Nauset Beach, Chatham	9 ^s	11 ^s	11	11	BK
Nauset Beach, Orleans	7	7	3	7	JLu, KC
Nauset Spit (Heights), Orleans	13 ^t	13 ^t	7	13	JLu, KC
New Island, Orleans	0	0	0	0	MH
Skaket Beach, Orleans	nd	nd	nd	nd	-
Rock Creek (north side), Orleans	nd	nd	nd	nd	-
First Encounter Beach, Eastham	nd	nd	nd	nd	-
Coast Guard Beach, Eastham	13	13	9	13	MH
Marconi Beach/LeCount Hollow, Wellfleet	7	8	8	8	MH
Sunken Meadow Spit, Wellfleet	1	1	4	1	JD
Lieutenant's Island, Wellfleet	1	1	0	1	HS, FS, DO
Indian Neck, Wellfleet	nd	nd	nd	nd	-

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Jeremy Point/Great Island, Wellfleet	13	13	19	13	MH
Pamet Harbor-South, Truro	0	0	0	0	KS
Pamet Harbor-North/Corn Hill Beach, Truro	2	2	5	2	KS
Pond Village Beach, Truro	nd	nd	nd	nd	-
Pilgrim Beach/Beach Point, Truro	4	4	11	4	KS
Ballston Beach/Newcomb Hollow, Truro	5	5	6	5	EH
Longnook Beach, Truro	0	0	0	0	EH
Highland Beach, Truro	0	0	0	0	EH
High Head/Head of the Meadow, Truro	2	2	6	2	EH
Race Point-South Beach, Provincetown/Truro	14	14	15	14	EH
Race Point-North Beach, Provincetown	5	5	1	5	EH
Long Point/Wood End, Provincetown	5	5	9	5	EH
BRISTOL COUNTY					
Stony Point Dike, Wareham	2	2	0	2	MZ
Long Beach Point, Wareham	0	nd	nd	nd	MZ
Little Harbor Beach, Wareham	0	nd	nd	nd	MZ

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Strawberry Point, Mattapoisett	0	nd	nd	nd	JHa
West Island, Fairhaven	2	2	1	2	JBo, SS, JP
Winsegansett Heights, Fairhaven	0	0	0	0	JBo, SS, JP
Round Hill Beach, Dartmouth	0	0	0	0	JBo, SS, JP
Salters Pond, Dartmouth	0	0	0	0	JBo, SS, JP
Demarest Lloyd State Park, Dartmouth	1	1	0	1	JBo, SS, JP
Little Beach/Barney's Joy, Dartmouth	12	12	16	12	JBo, SS, JP
Gooseberry Neck, Westport	1	1	2	1	JBo, SS, JP
Horseneck Beach, Westport	14	14	16	14	JBo, SS, JP
Acoaxet, Westport	0	0	0	0	CS
Cockeast Pond, Westport	1	1	3	1	CS
Richmond Pond, Westport	1 ^u	1 ^u	2	1	CS
Bay Point, Swansea	nd	nd	nd	nd	-
ELIZABETH ISLANDS					
Naushon Island	1	1	nd	0	JHa
Pasque Island-Robinson's Hole	nd	2	nd	0	JHa

2000

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Pasque Island-Cobbly	nd	0	nd	0	JHa
Pasque Island-Quick's Hole	nd	0	nd	0	JHa
Nashawena Island-Quick's Hole	2	2	3	2	LR
Nashawena Island-Canapitsit	nd	0	nd	0	JHa
Cuttyhunk Island	0	1	nd	0	SM, BB, JLun, JHa
Penikese Island	0	0	0	0	CM, GR
MARTHA'S VINEYARD					
Eastville Point Beach, Oak Bluffs	1	1	2	1	RCu, SJ, ND
Harthaven, Oak Bluffs	0	0	0	0	DS, GL
Sylvia State Beach, Edgartown	4 ^v	4 ^v	5	4	RCu, SJ, ND
Cow Bay, Edgartown	0	0	0	0	DS
Eel Pond/Little Beach/Lighthouse Beach, Edgartown ^w	2	2 ^x	4	2	DS, GL
Chappaquiddick Beach, Chappaquiddick	0	0	0	0	DS, GL, JR
Cape Pogue Elbow/The Narrows, Chappaquiddick	2	2	0	2	KC
Arruda's Pt./The Jetties, Chappaquiddick	1	1	1	1	KC
Leland/East Beaches, Chappaquiddick	1	1	0	1	KC

2000

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Wasque, Chappaquiddick	1	1	0	1	KC
Norton Point Beach, Edgartown	8	8	6	8	RCu, SJ, ND
South Beach, Edgartown	0	0	0	0	-
Edgartown Great Pond/Job's Neck, Crackatuxet Pd., Edgartown	2	2	1	2	DS, GL, JR
Oyster and Paqua Ponds, Edgartown	1	1	nd	0	DS, GL
Watcha Pond, W. Tisbury	0	nd	nd	nd	DS, GL
Tisbury Great Pond/Black Point Pond/Quansoo/Long Point, Chilmark ^y	5	6	4	6	DS, GL, LR
Chilmark Pond, Chilmark	1	1	2	1	DS, GL, RG
Lucy Vincent Beach, Chilmark	1	1	1	1	RCu, ND
Long Beach/Squibnocket Beach, Chilmark	4 ^{z,aa}	6 ^{z,aa}	5	6	DS, GL
Menemsha Beach, Menemsha ^{bb}	0	0	0	0	RCu
Moshup Trail Beach, Gay Head	1	1	1	1	DS, GL, JR, TD
Dogfish Bar, Gay Head	3	3	4	3	DS, GL
Lobsterville Beach, Gay Head	1	1	0	1	DS, GL
Cedar Tree Neck/Lambert's Cove, West Tisbury	0	0	0	0	DS, GL
Great Rock Bight Preserve	0	0	0	0	JR, TD

2000

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Sepiessa Point Reservation	0	0	0	0	JR, MD, TD
Tashmoo, Tisbury	3	3	1	3	DS, GL
Wilfred's Pd. and Mink Meadows Beach, Vineyard Haven	2	2	1	2	DS, GL, JR, MD, TD
Northern Pines Shores, Vineyard Haven	0	0	0	0	JR, MD, TD
Nomans Land	nd	nd	nd	nd	-
NANTUCKET					
Great Point	1	1	0	1	LR
The Galls	0	0	0	0	LR
Coskata-West Beach ^{cc}	1	1	0	1	LR
Coskata-Inner Trail ^{dd}	nd	nd	nd	nd	-
Coatue	1	1	1	1	KCB, JL
Coskata-East Beach ^{dd}	1	1	0	1	LR
Coskata Inlet/The Haulover ^{dd}	1	1	0	1	KCB, JL
Wauwinet	1	1	0	1	SP
Squam Pond	1	1	0	1	SP, KCB, JL

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs with fledge data	Source ^d
	Index Count ^a	Total Count ^b			
Quidnet/Sesachacha Pond	1	1	0	1	SP
Low Beach/Tom Nevers ^{ce}	8	8	28	8	VT, LaM, BP
Surfside	0	nd	nd	nd	SP
Hummock Pond	3 ^{ff}	3 ^{ff}	0	3	KCB, JL
Smith Point	10	10.5 ^{gg}	18	10.5	VT
Eel Point	3	4	0	4	KCB, JL
Dionis Beach	0	0	0	0	VT, LaM
Quaise Point	0	0	0	0	VT, LaM
Tuckernuck Island	3	3	nd	0	RV
Muskeget Island	8	8	18	8	RV
UNADJUSTED TOTALS	484	507.5^{hh}	524	498.5ⁱⁱ	
ADJUSTED TOTALS		496^j		487^{kk}	

^a Index Count = number of territorial pairs counted between 27 May and 4 June, 2000, the standardized Index Count period for the Atlantic Coast population.

^b Total Count = total number of territorial pairs present during all or a portion of the breeding season.

^c Chicks fledged are defined as chicks \geq 25 days of age or observed in flight, whichever occurs first.

^d Key to sources: AF = Amber Foster, AT = Amy Trautwein, BB = Brad Blodget, BK = Briana Kane, BP = Bruce Perry, BS = Ben St. George, BT = Beverly Titus, CF = Cindy Fennimore, CM = Carolyn Mostello, CMc = Christopher McDowell, CN = Christine Nelson, CS = Cheryl Swinconeck, DM = Deborah Melvin, DO = Dot Oberding, DS = Debra Swanson, EH = Ed Hoopes, FS = Fred Streams, FZ = Francios Zurif, GL = Greg Levandoski, GR = Gina Reppucci, HB = Holly Busse, HD = Holly Dowden, HS = Hazel Streams, JB = Jody Bartz, JBo = Jamie Bogart, JD = James Dwyer, JHa = Jeremy Hatch, JI = Joe Iafrate, JL = Jerome Light, Jr., JLu = Jason Luscier, JLun = Julie Lundgren, JP = Jon Perreira, JR = Julie Russell, JT = John Trautwein, KB = Keith Brunell, KC = Kate Condé, KCo = Kerry Collier, KCB = Karen Combs-Beattie, KM = Kelly Michael, KS = Kate Smolski, LJ = Laura Jones, LaM = Larry Miller, LM = Lauren Miller, LMc = Lauren McCubbin, LR = Lloyd Raleigh, MBa = Matt Bailey, MC = Michael Comforti, MD = Matt Dix, MH = Mary Hake, MJ = Martha Jason, ML = Mary Luddy, MR = Melissa Rose, MS = Melissa Sousa, MZ = Margo Zdravkovic, ND = Nathan Durawa, OM = Owen Muise, RCu = Robert Culbert, RG = Robin Guest, RK = Russ Keyes, RV = Richard Veit, SF = Sharon Fish, SH = Scott Hecker, SJ = Susan Jones, SKe = Shannon Keane, SKo = Stephanie Koch, SM = Scott Melvin, SP = Swede Plaut, SS = Sara Sampieri, SvO = Susi von Oettingen, TC = Tom Chamberlin, TD = Trella Dubetz, VT = Vincent Todd, WC = Wayne Castonguay

^e At Crane Beach, two new mates that replaced dead adults at two different nests are tallied as an additional pair.

^f A pair was scraping at Coffin's Beach during the Index Count period. Because the pair was present for less than two weeks, it was not tallied as a breeding pair in the Total Count.

^g nd = no data available

^h We assumed that pair 4 (nest overwashed on 7 Jun) at Duxbury Beach renested as pair 10 (first egg laid approximately 13 Jun).

ⁱ Ellisville includes both Ellisville State Park and the private beach along the south side of Ellisville Harbor.

^j It was reported, and we assumed, that pair 1 at Ellisville Harbor renested after chicks were lost at three days of age.

^k The Washburn Island site included a small sand island (Gull Island) adjacent to the western tip of the ocean-facing beach.

^l It was reported, and we assumed, that pairs 2 and 3 at Springhill Beach renested after chicks were lost at four days of age.

^m It was reported, and we assumed, that pair 2 at Scorton Neck renested after chicks were lost at four days of age.

ⁿ It was reported, and we assumed, that pair 1 at Scorton Shores renested after chicks were lost at two days of age.

^o It was reported, and we assumed, that pairs 1 and 20 at Sandy Neck renested after chicks were lost at five and one days of age, respectively.

^p This year is the first year that Bone Hill Road has been censused.

^q It was reported, and we assumed, that pair 1 at Kalmus Park Beach renested after chicks were lost by six days of age.

^r At South Beach, Chatham, two new mates that replaced dead adults at two different nests are tallied as an additional pair.

^s We assumed that pair 1 (nest lost to predation 23 May) at Nauset Beach, Chatham renested as either pair 13 (first egg laid approximately 14 Jun) or pair 14 (found with four eggs on 21 Jun).

^t It was reported, and we assumed, that pair 2 at Nauset Spit renested after chicks were lost at eleven days of age.

^u It was reported, and we assumed, that pair 1 at Richmond Pond renested after chicks were lost at one day of age.

^v It was reported, and we assumed, that pair 1 at Sylvia State Beach renested after chicks were lost at 11 days of age.

^w Little Beach and Lighthouse Beach were formerly reported separately.

^x A pair was scraping at Little/Lighthouse Beaches late-Apr to early May. Because the pair was present for less than two weeks, it was not tallied as a breeding pair in the Total Count.

^y This site also includes the Lewis property and Long Point Wildlife Refuge.

^z It was suspected, and we assumed, that pair 1 (nest abandoned 10 to 15 May) at Long Beach renested as pair 5 (found with four eggs 7 Jun) at Squibnocket Beach.

^{aa} It was reported, and we assumed, that pair 2 at Squibnocket Beach renested after chicks were lost immediately after hatching.

^{bb} This year is the first year that Menemsha Beach has been censused.

^{cc} Coskata-West Beach refers to the beach along the Nantucket Sound side of Coskata, from the south end of The Galls south and west to the boundary of Coatue. This is the same area that was referenced as Coskata-North Beach in 1993 and as part of The Galls in 1991 and 1992. Census data for Great Point, The Galls, and Coskata-West Beach were not reported separately in 1996 or 1997.

^{dd} Coskata-Inner Trail refers to the inland trail running south and west from Coskata toward Coatue. Coskata-East Beach refers to the beach along the eastern (Atlantic) side of Coskata, including the washover at The Glades. Coskata Inlet is the inlet from Nantucket Harbor into Coskata Pond.

^{ee} Low Beach/Tom Nevers runs from Siasconset south and west and includes the beach in front of Tom Nevers Head. In 1999, this site was split and reported as two sites: Low Beach/Tom Nevers, and Low Beach-Siasconset.

^{ff} It was reported, and we assumed, that pair 1 at Hummock Pond renested after the last remaining chick was lost when it was between ten and thirteen days old.

^{gg} We assumed that at Smith Point, after the female from pair 4 was killed (nest abandoned 14 May), the male from pair 4 found a new mate and renested as pair 9 (first egg found 26 May). The new mate that replaced the dead adult is tallied as an additional half-pair.

^{hh} The *Unadjusted Total Count* is the sum of the Total Counts reported at each site, not adjusting for potential double-counting.

ⁱⁱ The *Unadjusted total pairs with fledge data* is the sum of the values reported at each site, not adjusting for potential double-counting.

^{jj} The *Adjusted Total Count* is the midpoint between the *Index Count* and the *Unadjusted Total Count*, rounded to the nearest whole number of pairs.

^{kk} The Adjusted total pairs for with fledge data is the ratio of the Adjusted Total Count to the Unadjusted Total Count, multiplied by the Unadjusted total pairs with fledge data, and rounded to the nearest whole number of pairs.

Table 2. Comparison of Piping Plover nest success in Massachusetts, 2000, with and without predator exclosures.

Fate of nests	<u>Number of nests (%)^a</u>	
	With exclosure	Without exclosure
Successful ^b	253 (67)	78 (38)
Unsuccessful	124 (33)	126 (62)
Total	377 (100)	204 (100)

^a Not included in this table are 178 nests lost to flooding (134 exclosed, 44 unexclosed) that presumably would have been lost regardless of whether or not exclosures were used.

^b Nests were considered successful if they hatched ≥ 1 egg.

Table 3. Comparison of Piping Plover hatching success in Massachusetts, 2000, with and without predator exclosures.

Fate of nests	<u>Number of eggs (%)^a</u>	
	With exclosure	Without exclosure
Hatched	866 (62)	213 (37)
Depredated/failed	538 (38)	358 (63)
Total	1404 (100)	571 (100)

^a Not included in this table are 649 eggs lost to flooding (514 exclosed, 135 unexclosed) that presumably would have been lost regardless of whether or not exclosures were used.

Table 4. Reported causes of Piping Plover nest failures (n = 428) in Massachusetts, 2000.

Cause of nest failure	Number of nests		Total
	With exclosure	Without exclosure	
Overwash/flooding	134	44	178
Abandonment	97	21	118
Unknown predator	6	37	43
Crow	4	17	21
Skunk	4	7	11
Gull	1	6	7
Eggs failed to hatch ^a	6	1	7
Coyote	-	7	7
Fox	4	2	6
American Oystercatcher	-	2	2
Vandalism	1	1	2
Dog	-	1	1
Other ^b	-	4	4
Unknown	1	20	21
Total	258	170	428

^a Eggs were removed by plover monitors from 7 nests after ≥ 40 days of incubation. They were not abandoned.

^b "Other" causes of nest failure for unexclosed nests included 2 nests lost to skunk or coyote, 1 nest lost to skunk or gull, and 1 nest lost to an unidentified canid.

Table 5. Suspected causes of Piping Plover nest abandonments (n = 118) in Massachusetts, 2000.

Cause of nest abandonment	Number of nests		Total
	With exclosure	Without exclosure	
Unknown	41	13	54
Predator harassment ^a	16	0	16
Severe inclement weather ^b	11	5	16
Adult killed/died	10	0	10
Human disturbance/harassment	5	0	5
Non-predator disturbance ^c	3	0	3
Eggs failed to hatch	2	0	2
Territorial dispute with other PIPL pair	1	1	2
Multiple causes ^d	8	2	10
Total	97	21	118

^a "Predator harassment" included harassment by skunk (5 nests), coyote (3 nests), small mammal (2 nests), crow (2 nests), fox (1 nest), blackbird (1 nest), gull (1 nest), and cat (1 nest).

^b "Severe inclement weather" included strong winds, heavy rain, and high tides.

^c "Non-predator disturbance" included disturbance by deer (2 nests) and seals (1 nest).

^d "Multiple causes" included: dog and/or human disturbance (1 exclosed nest); skunk, deer, and/or weather disturbance (1 exclosed nest); skunk and/or crow disturbance (1 exclosed nest); weather and/or dog disturbance (1 exclosed nest); dog and/or crow disturbance (1 exclosed nest); weather and/or human disturbance (1 exclosed nest); weather and/or disturbance by neighboring PIPL brood (1 exclosed nest); crow and/or gull disturbance (1 exclosed nest); disappearance of part of clutch and/or disappearance of 1 adult (1 unexclosed nest); human disturbance and/or disappearance of part of clutch (1 unexclosed nest).

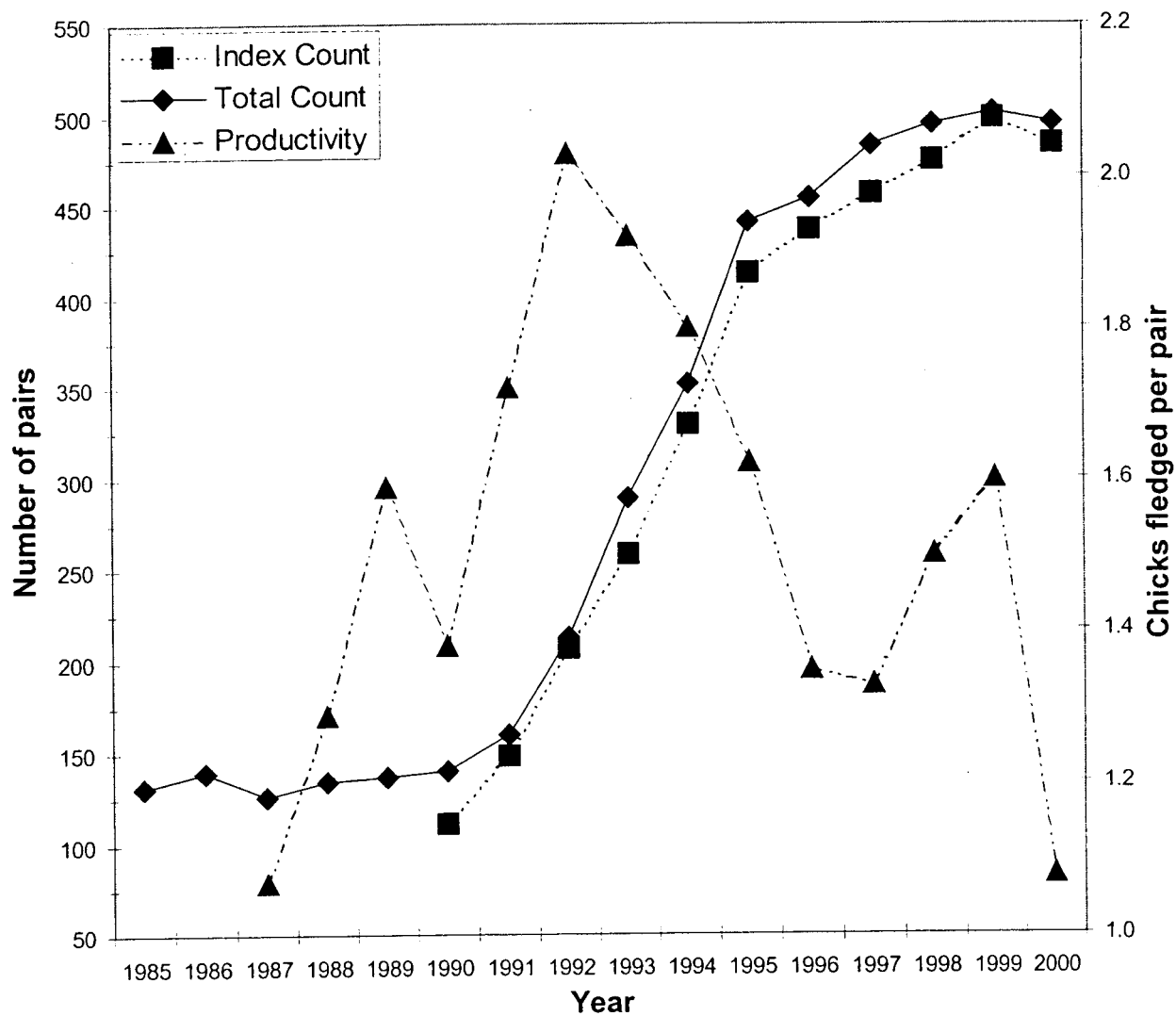


Figure 1. Abundance and productivity of Piping Plovers in Massachusetts, 1985-2000. In 2000, the total number of pairs is the Adjusted Total Count, and productivity is based this value.

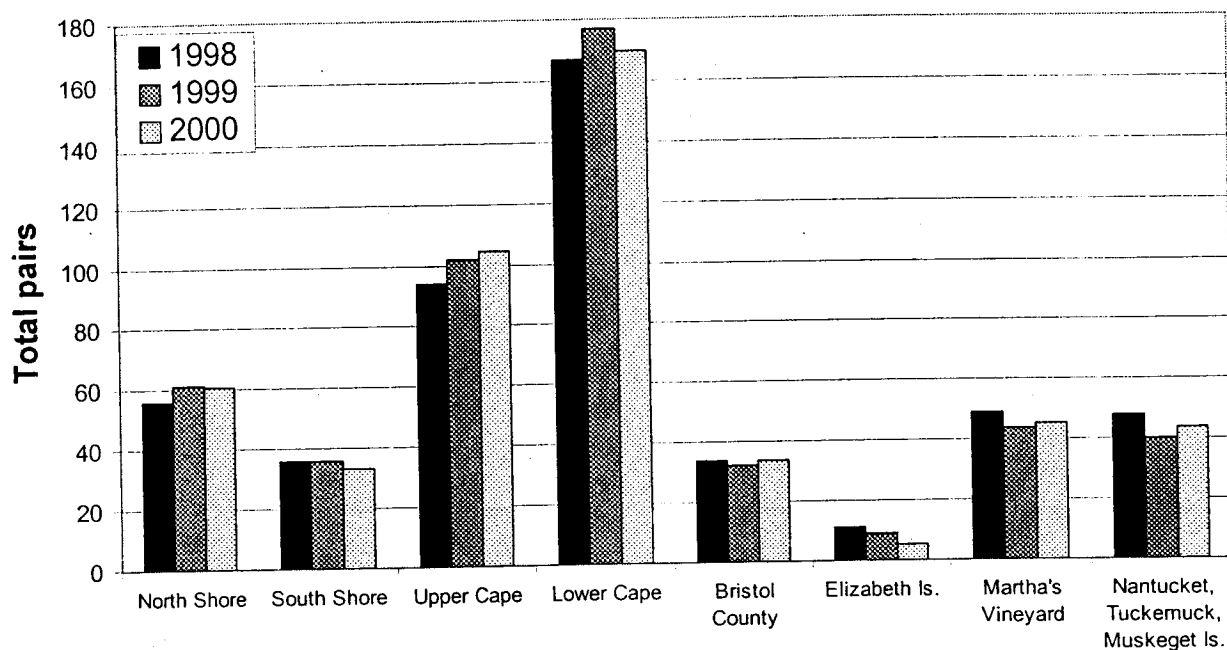


Figure 2. Abundance of Piping Plovers in Massachusetts by region, 1998-2000. In 2000, the values are the Adjusted Total Counts for each region.

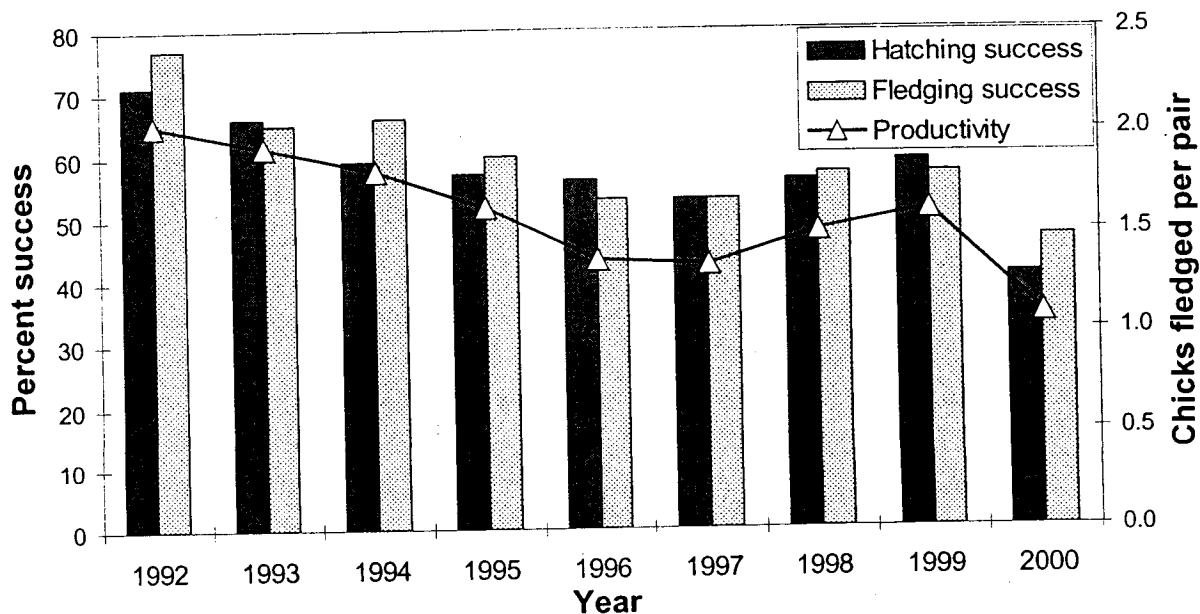


Figure 3. Hatching success, fledging success, and productivity of Piping Plovers in Massachusetts, 1992-2000. In 2000, productivity was based on the Adjusted Total Count.

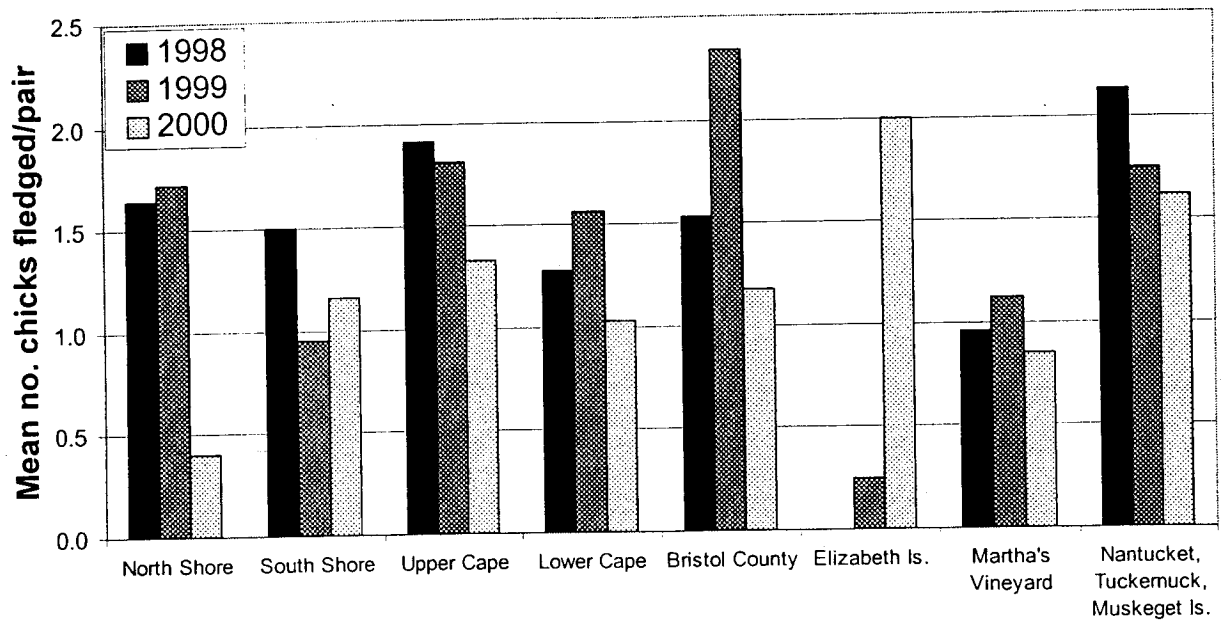


Figure 4. Productivity of Piping Plovers in Massachusetts by region, 1998-2000. In 2000, productivity was based on the Adjusted Total Counts for each region.